Norio SAHASHI*: **Morphological and taxonomical studies on Ophioglossales in Japan and the adjacent regions** (5)**

Sceptridium microphyllum, a new species, and its related taxa

佐橋紀男*: 日本および近隣産ハナヤスリ目の形態学的分類学的研究 (5)

新種イブリハナワラビとその近縁種について

(Pl. VII)

A small plant of *Sceptridium* was found by Mr. T. Kashiwagi and the author in grassy meadow on hillside at Mizumoto-cho, Muroran-shi, Hokkaido, at about 170 m above sea level in 1977 (Fig. 1-A). Afterwards Kashiwagi collected some plants closely resembled the first one from several places in Prov. Iburi, Hokkaido. The author examined these specimens in connection with two members of Sect. Multifida of *Sceptridium*, namely *S. nipponicum* and *S. minus*, and has reached the conclusion that a new species must be recognized in the present complex.

Sceptridium microphyllum Sahashi, sp. nov. (Fig. 1-A; Fig. 2-A, B).

Rhizoma breve, erectum, ad 2 cm longum. Stipes ca. 3 cm longus, ad 3 mm latus. Petiolus laminae sterilis ca. 4.5 cm longus. Lamina sterilis ambitu subdeltoidea ca. 4 cm longa, ca. 4.5 cm lata, bi-(tri)-pinnatifida. Pinnae infimae inaequaliter pinnatifidae ca. 2.6 cm longae, ca. 2 cm latae, petiolatae, petiolis ca. 8 mm longis. Pinnulae oblongae vel late lanceolatae, apice acutae, margine minute dentatae vel serratae. Panicula fertilis ca. 3.5 cm longa, oblonga, bipinnata, petiolo ca. 12 cm longo.

This species is similar to *S. nipponicum* and *S. minus* by typically ternate blades and elongated pinna with acute apex, but differs from them by size (ca. 18.5 cm high), compact sterile blades (ca. 4 cm long, 4.5 cm wide), longer sterile stalk for its size, spores having smaller lumina in the distal face, and blades becoming partly latericious-colored from late autumn to winter.

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** Continued from Journ. Jap. Bot. **55**: 73-80 (1980).

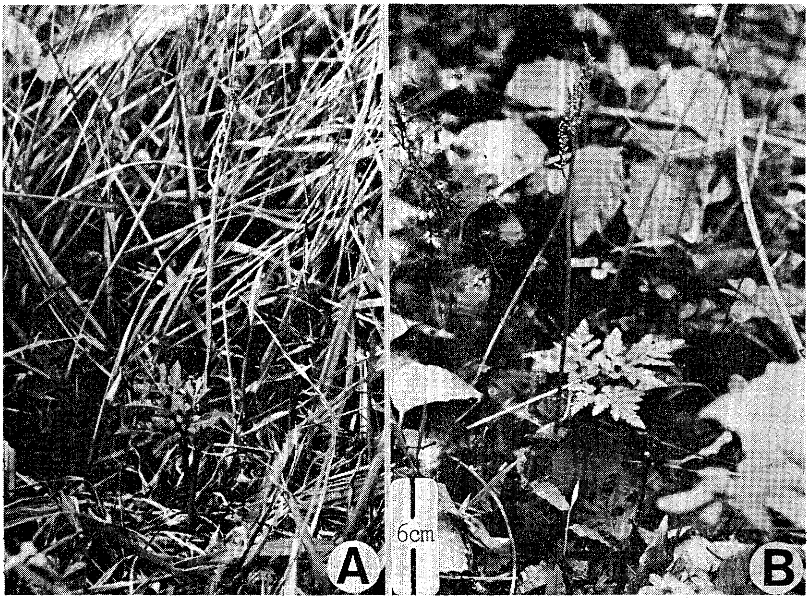


Fig. 1. A. Habitat of *Sceptridium microphyllum*, growing in grassy meadow, Muroran-shi, Hokkaido, the type locality. B. Habitat of *S. nipponicum* var. *minus*, growing in secondary forest, Karuizawa, Nagano Pref., near the type locality.

Nom. Jap. Iburi-hanawarabi, nom. nov.

Range: Endemic in Hokkaido, mainly in Prov. Iburi.

Hab. Hokkaido. Prov. Iburi: Mizumoto-cho, Muroran-shi, alt. ca. 170 m [N. Sahashi & T. Kashiwagi nos. 7792 (holotype in TNS no. 393417), 7793 (393418 in TNS), 7794, 7795 (393419 in TNS), 7796, 7797 and 7798, Oct. 1977, TOHO]. Abuta-cho, Abuta-gun, alt. ca. 150 m (T. Kashiwagi 7800, 7801, Oct. 1978, TOHO); ibid. (T. Kashiwagi 7950–7953, Nov. 1979, TOHO). Washibetsu, Noboribetsu-shi, alt. ca. 150 m (T. Kashiwagi 7749, Nov. 1977, TOHO); ibid. (T. Kashiwagi 7802–7804, Oct. 1978, TOHO); ibid. (T. Kashiwagi 7949, Oct. 1979, TOHO). Prov. Ishikari: Noboro national forest (T. Inokuma 5577, Sept. 1930, TOFO).

Rarely found in grassy meadows, bamboo thickets, or secondary forests. Typical plants usually grow on sunny places of grassy meadows, and have more compact sterile blades than those in secondary forests.

Spore morphology (Pl. VII). *Shape*: Trilete, often irregular in outline.

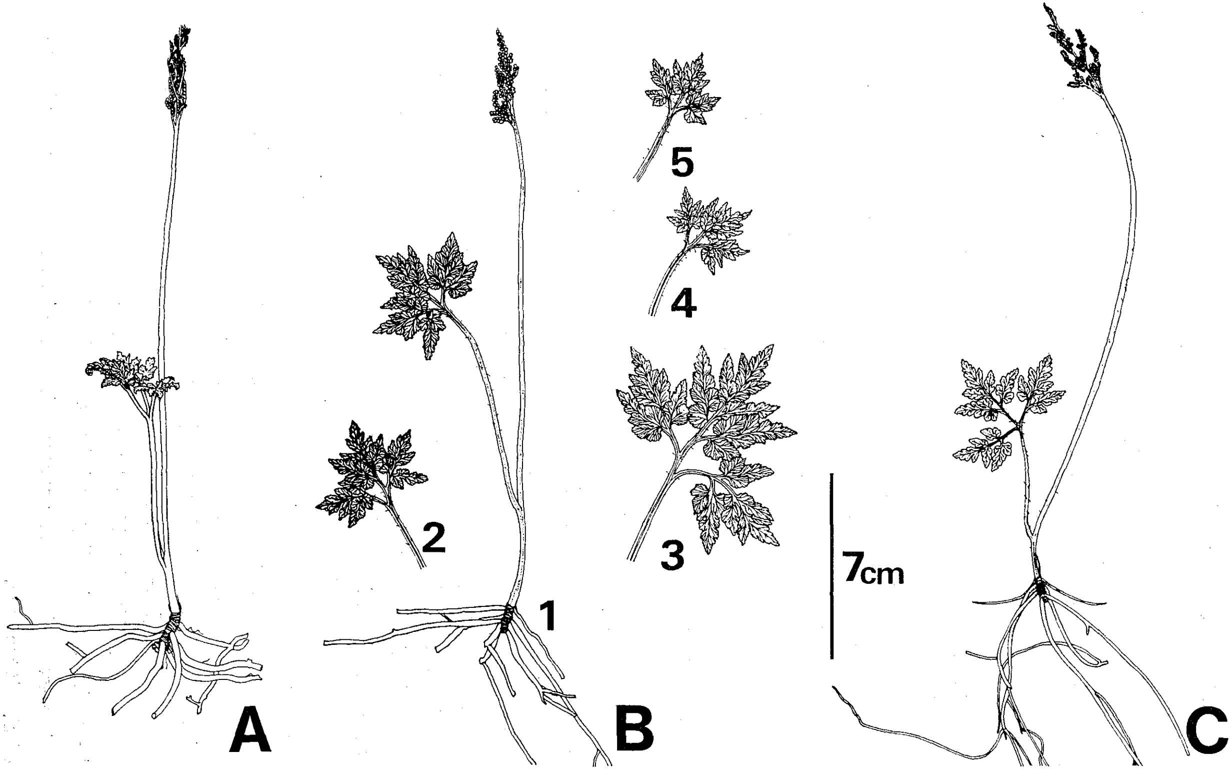


Fig. 2. A. *Sceptridium microphyllum* (sketch of a living plant; the material for cytological study, collected from Muroran-shi, Hokkaido). B. The type specimens of *S. microphyllum*. 1. Holotype, Sahashi & Kashiwagi no. 7792 (393417 in TNS). 2–5. Sterile blades of paratypes. 2. no. 7794, 3. no. 7796, 4. no. 7797 and 5. no. 7795 (393419 in TNS). C. *S. nipponicum* var. *minus*, from Karuizawa, Nagano Pref., near the type locality (Sahashi no. 7677 in TOHO).

Amb subtriangle to often rounded triangle or triquete, proximal part flat to convex and distal one convex to hemispherical in equatorial view. *Size*: 25.0 (22.0–27.0) × 28.0 (26.0–30.5) μm, and 37.0 (32.0–43.0) μm in equatorial diameter after acetolysis. *Laesura*: 10–15 μm long, somewhat prominent, up to 2 μm tall at the proximal pole. *Exine*: Light yellow, semitransparent, ca. 1.5 μm thick, and ca. 3 μm thick after acetolysis, in the optical section by the light microscope is shown verruca-like projections, and distal face is ornamented subreticulum-like or often fossulate-like pattern, faintly punctate on proximal face. On SEM observations, the distal face is usually subreticulum-like pattern (Pl. VII. C, D), or rarely rugulo-reticulate (Pl. VII. B). On the contrary, the proximal face is punctate especially in contact area (Pl. VII. A). The small granular projections are scattered all over the surface of the spore.

Cytological observations (Fig. 3). 45 bivalent chromosomes were counted on the first meiotic division (Fig. 3. B, E). In the allied species, *S. nipponicum* from Pref. Miyagi, northern Honshu, and *S. minus* from Pref. Nagano, central Honshu, also 45 bivalent chromosomes were counted in meiosis (Fig. 3. A, D; C, F).

Status of *Sceptridium minus*.

Botrychium japonicum var. *minus* was first proposed by Hara (1933), and Tagawa (1958) considered it as an independent species *Sceptridium minus*, with regard to spore character. Nishida (1959, 1960) considered that *S. minus* must be derived from *S. multifidum*, and *S. nipponicum* from *S. ternatum*. However, from the author's investigation on some taxa of *Sceptridium* in the field as well as by cultivation in garden, the following phenomena were observed: (1) The blades of *S. nipponicum* and *S. minus* change into latericious-color during late autumn and winter, but those of *S. ternatum* and *S. multifidum* normally remain green throughout winter; (2) The pinnae of *S. nipponicum* and *S. minus* usually are elongate and acute at the apex, on the contrary those of *S. ternatum* and *S. multifidum* usually are ovate and obtuse; (3) The habitat and size of *S. nipponicum* are various in lowland (up to 500 m), whereas *S. minus* grows only in *Fagus* zone (750–1500 m) and has smaller size; (4) *S. nipponicum* is widely distributed in Honshu, Shikoku, Kyushu and even in Korea, but *S. minus* is found at the type locality and its adjacent districts in central Honshu. From these reasons the author proposes that *S. minus* must be regarded as a variety of *S. nipponicum*.

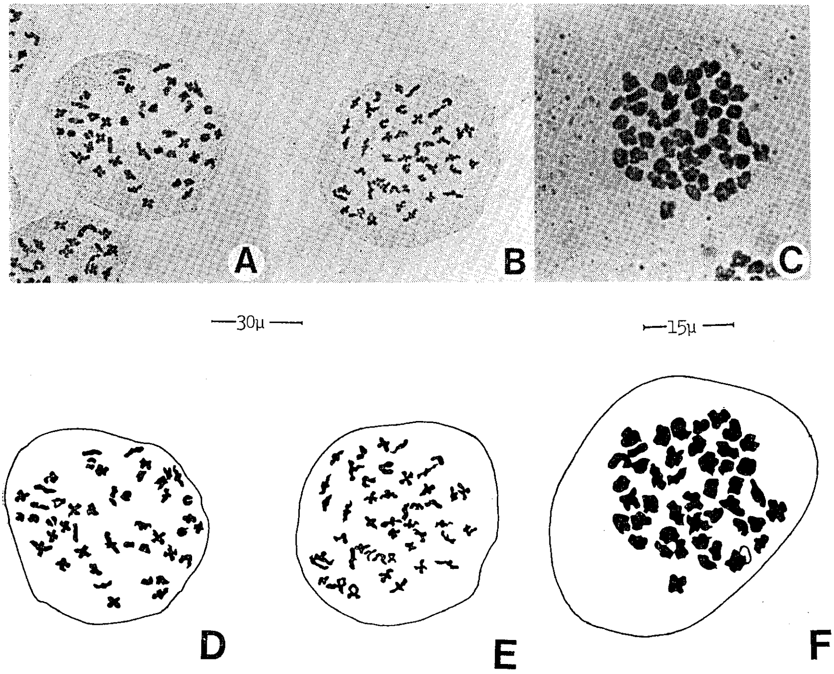


Fig. 3. Photomicrographs and their sketches of spore mother cells in meiosis. A, D. *S. nipponicum* var. *nipponicum* from Isl. Miyato-jima, Naruse-cho, Miyagi Pref., showing 45 bivalents. B, E. *S. microphyllum* from Mizumoto-cho, Muroran-shi, Hokkaido, showing 45 bivalents. C, F. *S. nipponicum* var. *minus* from Karuizawa, Nagano Pref., showing 45 bivalents.

Sceptridium nipponicum (Makino) Holub, Preslia **45**: 277 (1973); Nakaike in Ohwi, Fl. Jap. 247 (1978); Sahashi, Journ. Jap. Bot. **54**: 246 (1960).

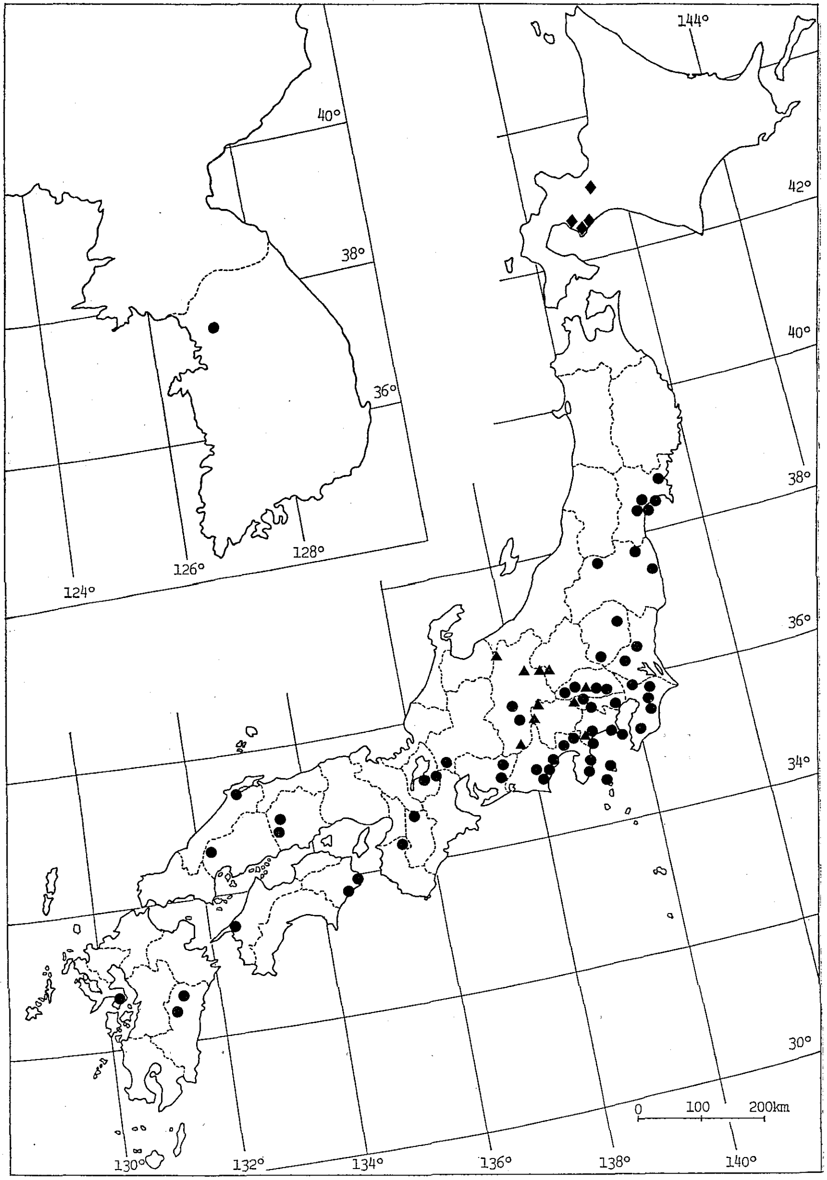
Var. **nipponicum.**

Syn. *Botrychium nipponicum* Makino, Journ. Jap. Bot. **1**: 5 (1916).

Sceptridium ternatum (Thunb.) Lyon var. *nipponicum* (Makino) Nishida ex Tagawa, Journ. Jap. Bot. **34**: 137 (1959).

Botrychium japonicum (non Und.) H. Ito, Journ. Jap. Bot. **49**: 361 (1974).

Hab. Northern Honshu: Prefs. Miyagi and Fukushima. Central Honshu: Prefs. Tochigi, Ibaraki, Saitama, Tokyo, Chiba, Kanagawa, Nagano, Shizuoka, Aichi, Gifu, Wakayama and Nara. Western Honshu: Prefs. Okayama, Hiroshima and Shimane. Shikoku: Prefs. Ehime and Tokushima. Kyushu: Prefs.


144°
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136°
138°
140°
0
100
200km

Nagasaki and Miyazaki. Korea (Kwang Nung near Seoul, Y. N. Lee et al., Sept. 1967, deposited in TI).

Var. **minus** (Hara) Sahashi comb. nov. (Fig. 1-B; Fig. 2-C).

Syn. *Botrychium japonicum* (Prantl) Und. var. *minus* Hara, Journ. Jap. Bot. **9**: 127 (1933).

Sceptridium minus (Hara) Nishida ex Tagawa, Journ. Jap. Bot. **33**: 201 (1958).

Hab. Central Honshu: Prefs. Gunma, Nagano, Saitama, Tokyo, Yamanashi and Kanagawa.

Key to three Japanese taxa of *Sceptridium* Sect. Multifida.

From the results of this study, it is concluded that three Japanese taxa of Sect. Multifida are summarized in the following key.

A. Plants ca. 18.5 cm high; blades compact, with short stalks of three major pinnae and partly latericious-colored in winter; spores usually with smaller lumina. Plants endemic in Hokkaido ....*S. microphyllum.*

A. Blades large or rather compact and wholly latericious-colored in winter; spores usually with large lumina .... B.

  B. Plants ca. 37 cm high; blades rather lax, with longer stalks of three major pinnae; pinnae with mostly minutely serrate. Plants of lowlands (up to 500 m) .... *S. nipponicum* var. *nipponicum.*

  B. Plants ca. 27 cm high; blades rather compact, with short stalks of three major pinnae; pinnae with minutely dentate to serrate. Plants of uplands (750-1500 m), endemic in central Honshu ....*S. nipponicum* var. *minus.*

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Fig. 4. Distributional map of three taxa of *Sceptridium* in Japan and Korea based on the specimens in author's collection and the principal herbaria in Japan.
● *S. nipponicum* var. *nipponicum.* ▲ *S. nipponicum* var. *minus.* ◆ *S. microphyllum.*

for drawing the figures in the present paper.

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Explanation of plate VII

A-D. Spores of *Sceptridium microphyllum*. A. Polar view, proximal face, showing laesurae (trilete mark). B. Polar view, distal face, showing rugulo-reticulate pattern. C. Polar view, distal face, showing subreticulum-like pattern. D. A part of distal face of C, showing densely granules on the muri.

E-F. Spores of *S. nipponicum* var. *minus*. E. Polar view, distal face, showing rugulo-reticulate pattern. F. A part of distal face of E, showing somewhat complicated muri.

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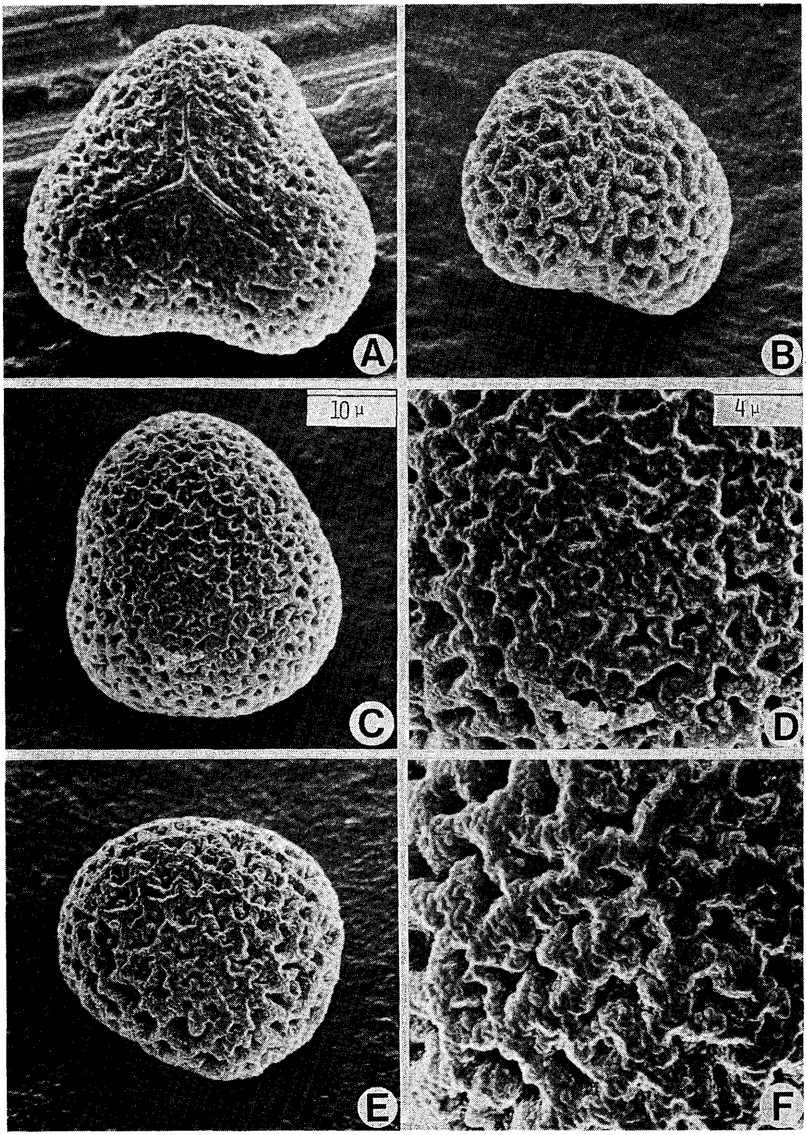
1977年10月，北海道，室蘭市の郊外で採集したハナワラビは大変小型で，形態がアカハナワラビやウスイハナワラビに似ているが，冬期部分的にのみ紅変する点や，小型の割には裸葉柄が長いこと，小羽片が比較的重なり合うこと，胞子表面の網目模様が細かいことなどの点から新種と結論し，和名をイブリハナワラビとした。一方アカハナワラビとウスイハナワラビの自生地の調査や，栽培中の観察結果から，ウスイハナワラビをアカハナワラビの変種と結論した。そしてアカハナワラビが高地に登り矮小化したものがウスイハナワラビと見る方がより妥当と考える。

アカハナワラビの染色体数は n=45 とすでに報告されているが，ウスイハナワラビの n=45 の報告は今回が初めてと思う。またイブリハナワラビも n=45 であった。

アカハナワラビの分布はこれまであまりよく知られていなかったが，東北地方（宮城県）から四国，九州に分布し，特に関東中部地方の太平洋岸に多いことがわかった。また東京大学理学部（ＴＩ）の標本中に１点，韓国のソウル近郊で採集されたアカハナワラビを見出した。日本以外の新産地である。ウスイハナワラビは長野県およびその近県で採集されているが，自生地は海抜 750〜1500 m の二次林，ブナ帯であり，おもに平地一低山帯の海抜 500 m 以下に自生するアカハナワラビとは住み分けている。



N. SAHASHI: Ophioglossales in Japan